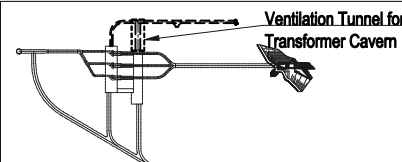


PLAN OF VENTILATION TUNNEL FOR MAIN TRANSFORMER CAVERN

1:500

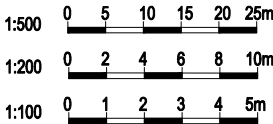
KEY PLAN



NOTE

1. All dimensions are in millimeters, and coordinates, chainages & elevations are in meters.
2. Since the cross-section and geological conditions of the additional ventilation tunnel for Transformer cavern are similar to the existing ventilation tunnel for Powerhouse, thence, the same support pattern is applied.

SCALE:



REFERENCE DRAWINGS

- UT1-C-300-CVL-DG-60001 Arrangement Drawing of Underground Powerhouse and Transformer Cavern
- UT1-C-385-CVL-DG-65001 Layout Drawing of Investigation Tunnel for Powerhouse

SYMBOL AND LEGEND

FOR APPROVAL

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| REV. NO. | DATE        | DESCRIPTION | DRAWN  | CHKD.          | APPD.       |
|----------|-------------|-------------|--------|----------------|-------------|
| 0A       | 17/APR/2023 | FIRST ISSUE | Vishnu | ZHANG JI QIANG | LI WEI GONG |

PROJECT TITLE  
Upper Trishuli-1 HEP (216MW)

OWNER  
NWEDC  
NIPAL WATER AND ENERGY DEVELOPMENT CO. (PVT) LTD.

OWNER'S ENGINEER  
TRACTEBEL  
ENGGIE  
jade CONSULT

CONTRACTOR  
DOOSAN Enerbility

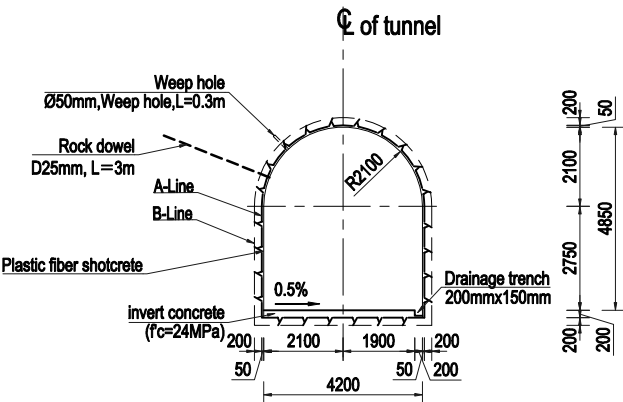
DRAWING TITLE  
EXCAVATION AND SUPPORT DRAWINGS OF VENTILATION TUNNEL FOR TRANSFORMER CAVERN (1/4)

| INDEX | DRAWING NUMBER            | SHEET NO. | REV. NO. |
|-------|---------------------------|-----------|----------|
| A     | UT1-C-385-CVL-DG-65005-01 | 1 OF 4    | 0A       |

A1 (594 x 841 MM) 1

TYPICAL SECTION (X-X)

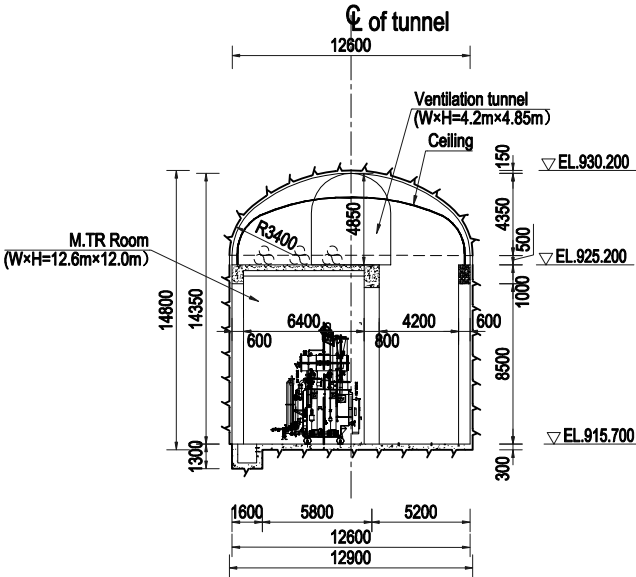
1:100



- Note:
- (1) The typical section indicates a section with the required clear space, only.
- (2) The excavation profile depends on the rock class and the respective support thickness.

SECTION VIEW (Y-Y)

1:200



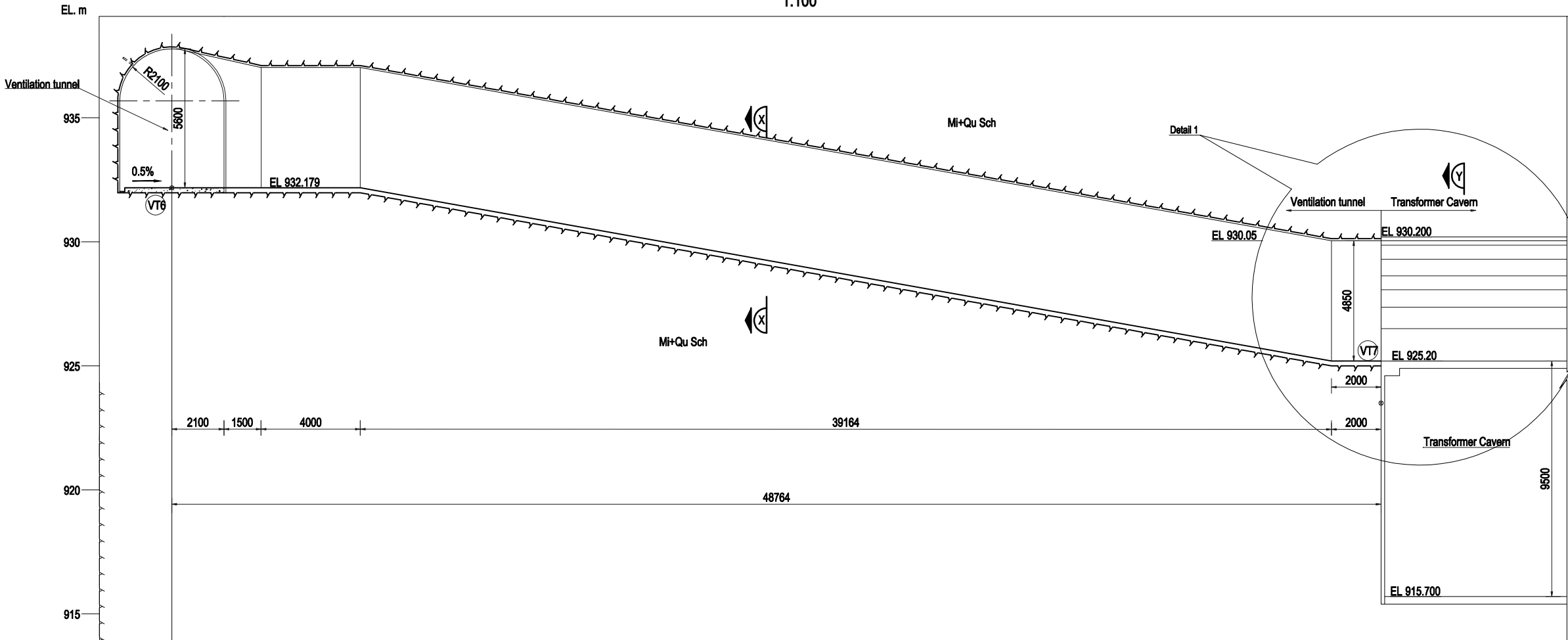
OCCURRENCE & MECHANICAL PARAMETER OF JOINTS

| OCCURRENCE & MECHANICAL PARAMETER OF JOINTS |                                                                |     |               |                              |             |          |        |                  |
|---------------------------------------------|----------------------------------------------------------------|-----|---------------|------------------------------|-------------|----------|--------|------------------|
| Joint type                                  | Joint No.                                                      | Dip | Dip direction | Discontinuity Frequency      | Persistence | C, (MPa) | Φ, (°) | Tunnel direction |
| foliation                                   | J1                                                             | 20° | 340°          | Each of the spacing 0.5–1.0m | 30–50m      | 0.20     | 35.0   | N3° E            |
| lithoclasts cemented                        | J2                                                             | 70° | 235°          | Each of the spacing 2.0–4.0m | 15m         | 0.15     | 28.8   |                  |
|                                             | J3                                                             | 60° | 25°           | Each of the spacing 2.0–5.0m | 15m         |          |        |                  |
| Note:                                       | Parameters are estimates, only, except Dip and Dip Direction,. |     |               |                              |             |          |        |                  |

A1 (594 x 841 MM) 1

LONGITUDINAL PROFILE OF VENTILATION TUNNEL FOR MAIN TRANSFORMER CAVERN

1:100



|                      |             |             |                  |             |             |             |             |             |              |              |
|----------------------|-------------|-------------|------------------|-------------|-------------|-------------|-------------|-------------|--------------|--------------|
| Chainage(m)          | CH 0+000.00 | CH 0+002.10 | CH 0+003.60      | CH 0+007.60 | CH 0+012.10 | CH 0+021.10 | CH 0+031.10 | CH 0+041.10 | CH 0+046.764 | CH 0+048.764 |
| Elevation(m) & Slope | 932.179     | 932.179     | Level<br>L=5.50m | 932.179     |             |             |             |             | 925.200      | 925.200      |
| Overburden thickness | 243.521     |             |                  |             |             |             |             |             |              | 252.200      |
| Assumed Rock class   | II ~ III    |             |                  |             |             |             |             |             |              |              |

TUNNEL SUPPORT PATTERN

|                                               |                 |            |        |                               |                            |                                                                                                                                                             |
|-----------------------------------------------|-----------------|------------|--------|-------------------------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rock mass quality                             | 40≥Q            | 10≤Q<40    | 4≤Q<10 | 1≤Q<4                         |                            | Q<1                                                                                                                                                         |
| Q value of rock mass quality for calculation  | 40              | 25         | 7      | 2.5                           |                            | 0.5                                                                                                                                                         |
| Support type                                  | I               | II         | III    | IV<br>(Without steel support) | IV<br>(With steel support) | V<br>Same as type IV (With steel support)                                                                                                                   |
| Inner dimension(m)                            | W=4.2m, H=4.85m |            |        |                               |                            |                                                                                                                                                             |
| Excavation Parameter                          |                 |            |        |                               |                            |                                                                                                                                                             |
| ESR                                           | 1.3             | 1.3        | 1.3    | 1.3                           |                            | 1.3                                                                                                                                                         |
| Excavation span(m)                            | 3               | 3          | 2      | 1.5                           |                            | 0.5~1                                                                                                                                                       |
| Calculated MUS*(m)                            | 11              | 9          | 5      | 3                             |                            | 1                                                                                                                                                           |
| MUS* for shotcrete application(m)             |                 | 9          | 2      | 1.5                           |                            | 1                                                                                                                                                           |
| MUS* for rock dowel installation(m)           |                 | 6          | 4      | 3.0                           |                            | 0.5~1                                                                                                                                                       |
| MUS* for steel support installation(m)        |                 |            |        |                               |                            | 0.5~1                                                                                                                                                       |
| Excavation method                             | Blasting        |            |        | Blasting/mechanically         |                            | Mechanically                                                                                                                                                |
| Initial support parameters                    |                 |            |        |                               |                            |                                                                                                                                                             |
| Weep hole, Φ50mm,L=0.3m                       | where necessary |            |        |                               |                            |                                                                                                                                                             |
| Plastic fiber shotcrete,f <sub>c</sub> =25MPa | Spot            | T=50mm     | T=75mm | T=120mm                       | T=160mm                    | For class V rock, the same support scheme as class IV rock can be adopted after grouting is used to improve the integrity and firmness of surrounding rock. |
| Rock dowel, D25,L=3m,alternately              | Spot            | @2.5m×2.5m | @2m×2m | @1.5m×1.5m                    | @1m×1m                     |                                                                                                                                                             |
| Steel support, MB150 (or lattice girder)      |                 |            |        |                               | @1m                        |                                                                                                                                                             |
| Forepoling grouted dowel,D25mm, @400mm, L=6m  |                 |            |        |                               | where necessary            |                                                                                                                                                             |
| *MUS, Maximum Unsupported Span.               |                 |            |        |                               |                            |                                                                                                                                                             |

NOTE

- All dimensions are in millimeters, and coordinates, chainages & elevations are in meters.
- Other see sheet 1.

LEGEND:

- SW Inferred boundry between moderately weathered and slight weathered
- MW Excavation line

SCALE:

1:100 0 1 2 3 4 5m

REFERENCE DRAWINGS

- UT1-C-300-CVL-DG-60001 Arrangement Drawing of Underground Powerhouse and Transformer Cavern
- UT1-C-385-CVL-DG-65001 Layout Drawing of Investigation Tunnel for Powerhouse

SYMBOL AND LEGEND

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| OR       | 17/APR/2023 | FIRST ISSUE | Vishnu | ZHANG JI QIANG | LI WEI GONG |
| REV. NO. | DATE        | DESCRIPTION | DRAWN  | CHKD.          | APPD.       |

PROJECT TITLE  
Upper Trishuli-1 HEP (216MW)

OWNER  
NWEDC  
NIPAL WATER AND ENERGY DEVELOPMENT CO. (PVT) LTD.

OWNER'S ENGINEER  
TRACTEBEL  
ENGGIE  
jade CONSULT

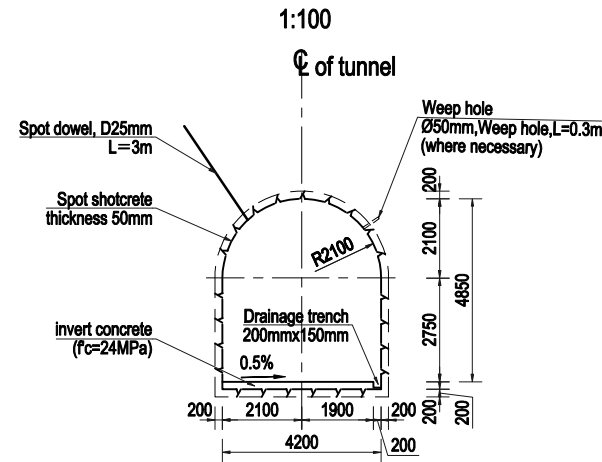
CONTRACTOR  
DOOSAN Enerbility

DRAWING TITLE  
EXCAVATION AND SUPPORT DRAWINGS OF VENTILATION TUNNEL FOR TRANSFORMER CAVERN (2/4)

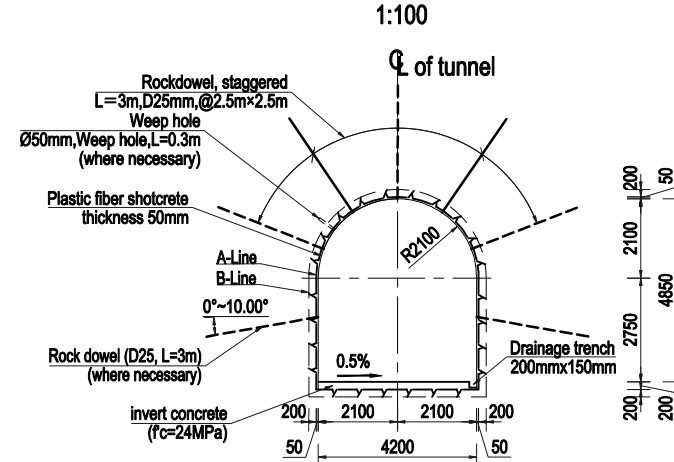
|       |                           |           |          |
|-------|---------------------------|-----------|----------|
| INDEX | DRAWING NUMBER            | SHEET NO. | REV. NO. |
| A     | UT1-C-385-CVL-DG-65005-02 | 2 OF 4    | 0A       |

A1 (594 × 841 MM) 1

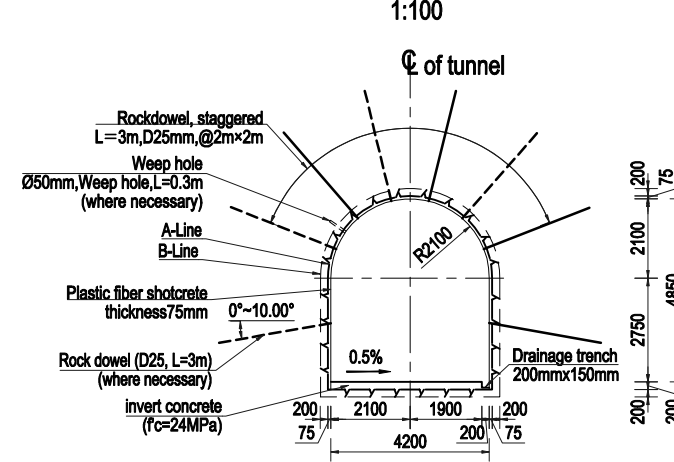
### SUPPORT TYPE OF ROCK CLASS I



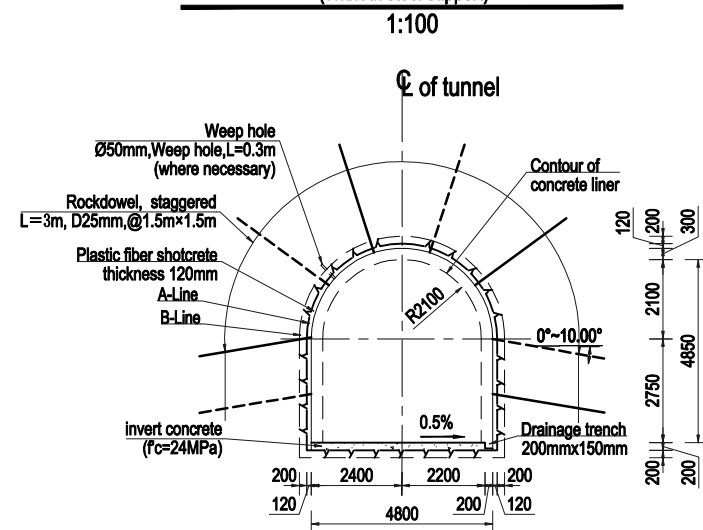
### SUPPORT TYPE OF ROCK CLASS II



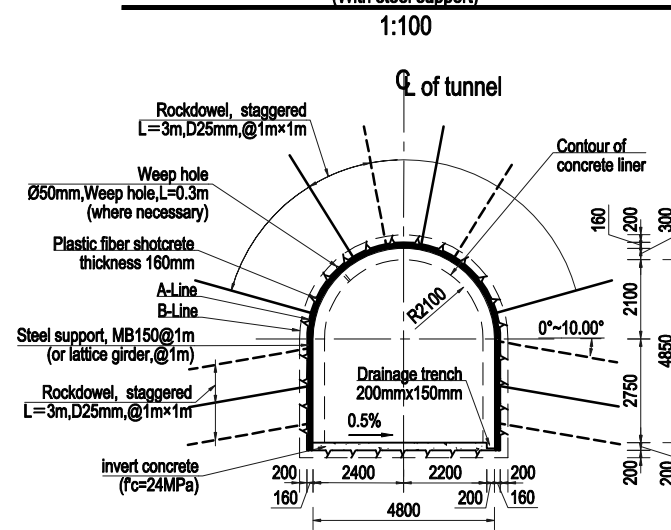
### SUPPORT TYPE OF ROCK CLASS III



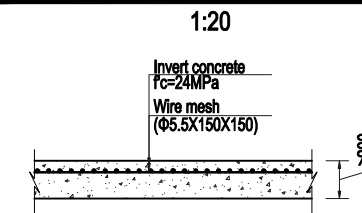
### SUPPORT TYPE OF ROCK CLASS IV (Without steel support)



### SUPPORT TYPE OF ROCK CLASS IV (With steel support)



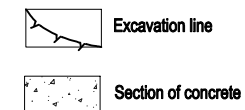
### DETAIL OF INVERT CONCRETE



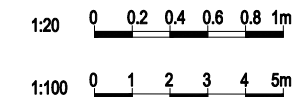
#### NOTE

1. This set of drawings are the excavation and support of ventilation tunnel for main transformer cavern.
2. All dimensions are in millimeters, and coordinates, chainages & elevations are in meters.
3. Other see sheet 1.

#### LEGEND:



#### SCALE:



#### REFERENCE DRAWINGS

|                        |                                                                      |
|------------------------|----------------------------------------------------------------------|
| UT1-C-300-CVL-DG-60001 | Arrangement Drawing of Underground Powerhouse and Transformer Cavern |
| UT1-C-385-CVL-DG-65001 | Layout Drawing of Investigation Tunnel for Powerhouse                |

#### SYMBOL AND LEGEND

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PROJECT TITLE  
Upper Trishuli-1 HEP (216MW)

OWNER  
**NWEDC**  
NEPAL WATER AND ENERGY DEVELOPMENT CO. (PVT) LTD.

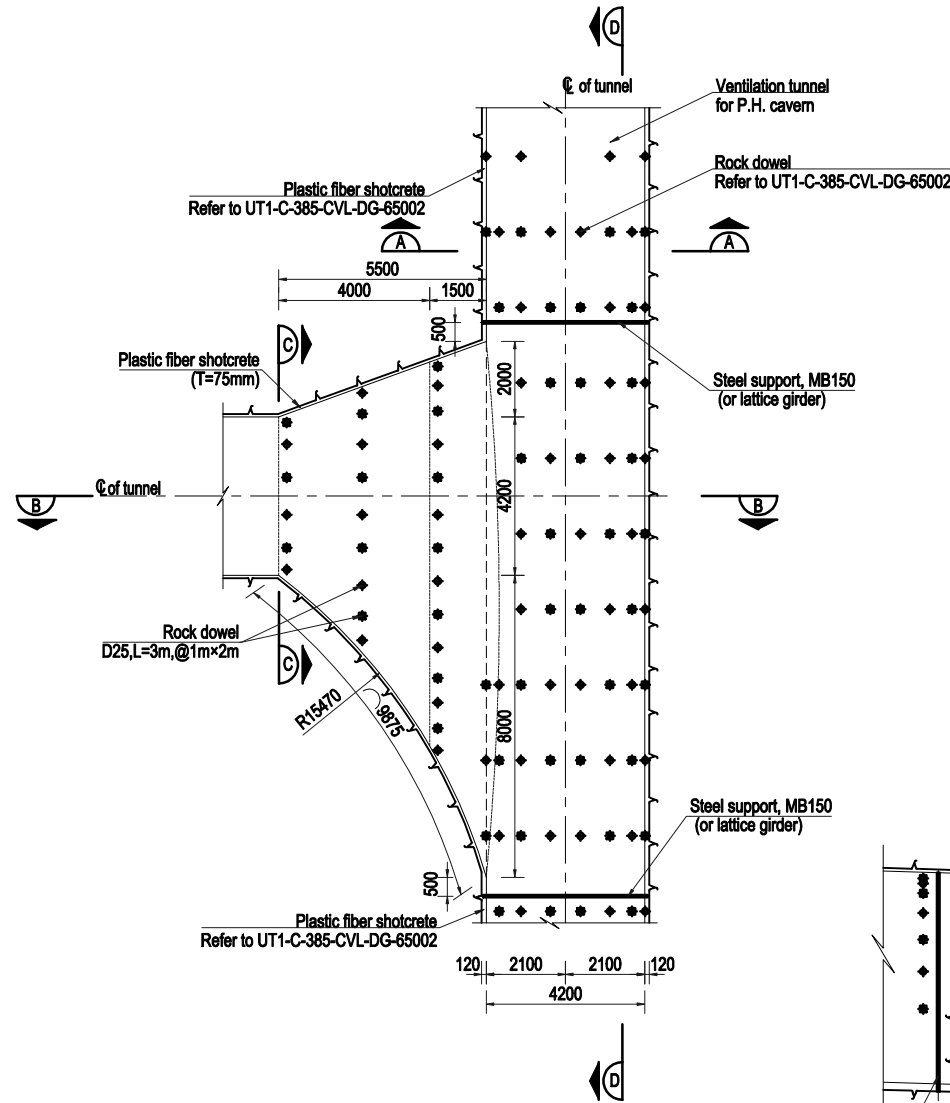
OWNER'S ENGINEER  
**TRACTEBEL** **ENGIN** **JADE CONSULT**

CONTRACTOR  
**DOOSAN Enerbility**

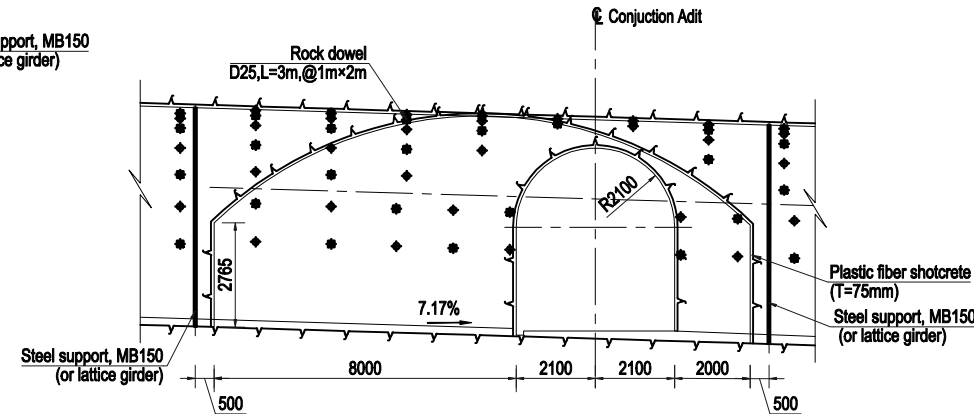
DRAWING TITLE  
EXCAVATION AND SUPPORT DRAWINGS OF VENTILATION TUNNEL FOR TRANSFORMER CAVERN (3/4)

| INDEX | DRAWING NUMBER            | SHEET NO. | REV. NO. |
|-------|---------------------------|-----------|----------|
| A     | UT1-C-385-CVL-DG-65005-03 | 3 OF 4    | 0A       |

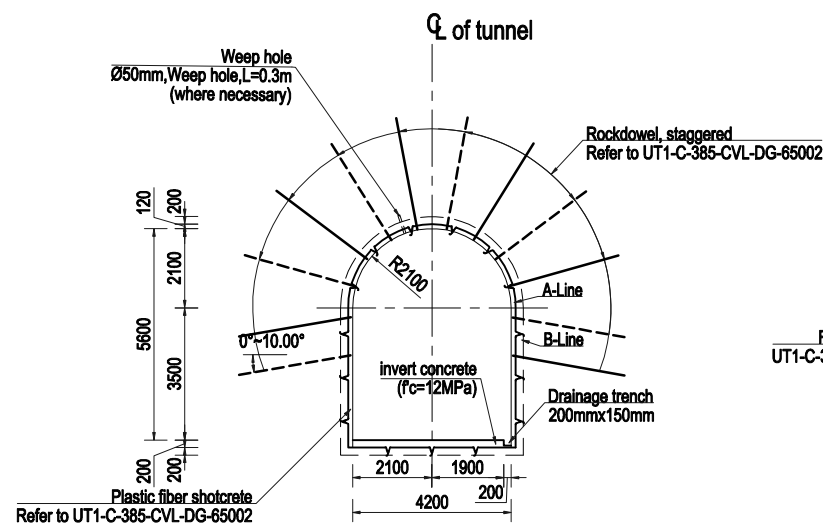
# PLAN OF CONJUNCTION (Rock Class III) 1:100



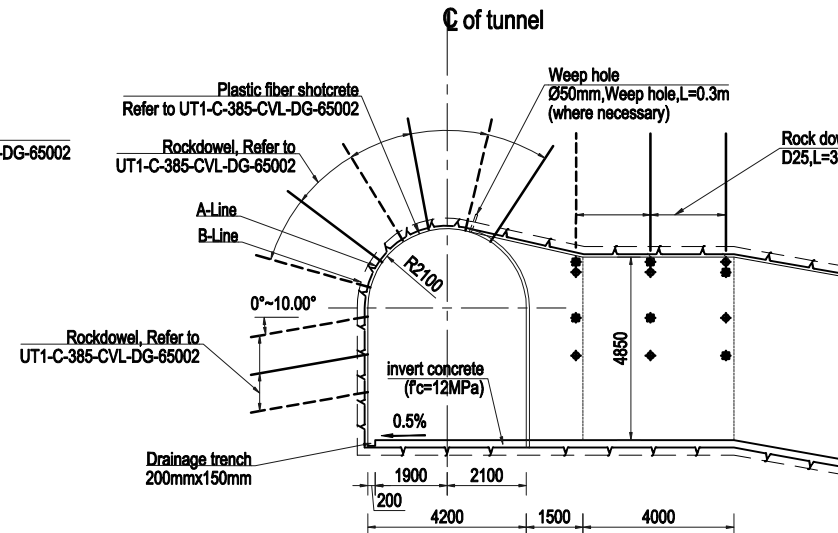
## SECTION D-D 1:100



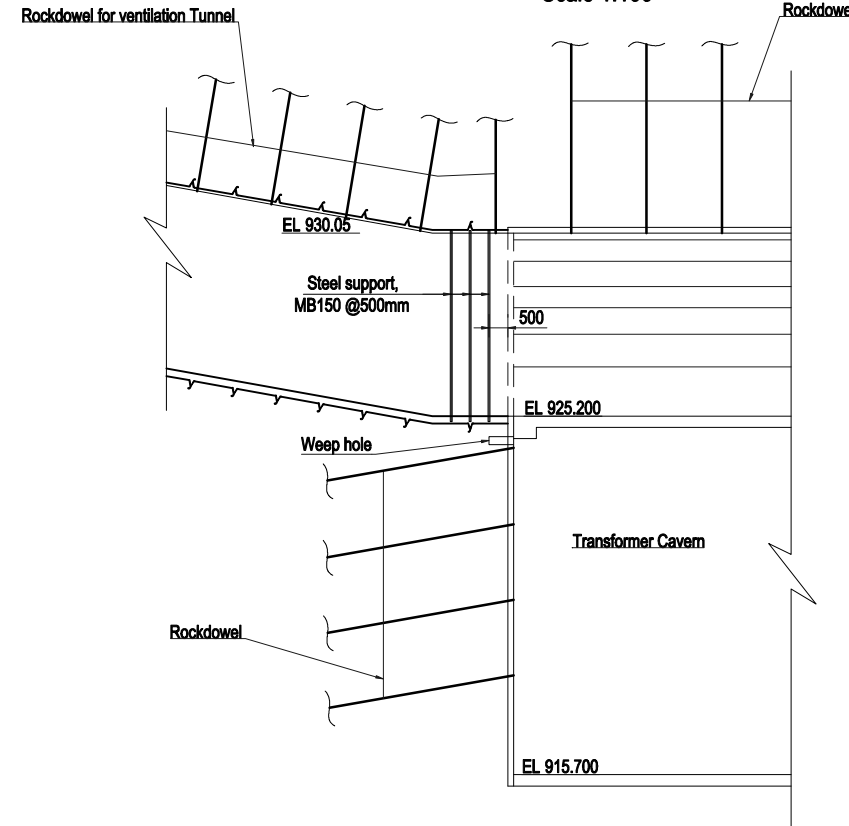
## SECTION A-A 1:100



## SECTION B-B 1:100



## DETAIL 1 (Detail of the Conjunction with Transformer Cavern) Scale 1:100



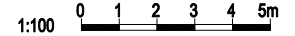
### NOTE

1. All dimensions are in millimeters, and coordinates, chainages & elevations are in meters.
2. Other see sheet 1.

### LEGEND:

- ◆ System rockdowel
- Additional rockdowel
- Excavation line
- ▨ Section of concrete

### Scale:



### REFERENCE DRAWINGS

|                        |                                                                      |
|------------------------|----------------------------------------------------------------------|
| UT1-C-300-CVL-DG-60001 | Arrangement Drawing of Underground Powerhouse and Transformer Cavern |
| UT1-C-385-CVL-DG-65001 | Layout Drawing of Investigation Tunnel for Powerhouse                |

### SYMBOL AND LEGEND

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DRAWING TITLE  
EXCAVATION AND SUPPORT DRAWINGS OF VENTILATION TUNNEL FOR TRANSFORMER CAVERN (4/4)

| INDEX | DRAWING NUMBER            | SHEET NO. | REV. NO. |
|-------|---------------------------|-----------|----------|
| A     | UT1-C-385-CVL-DG-65005-03 | 4 OF 4    | 0A       |